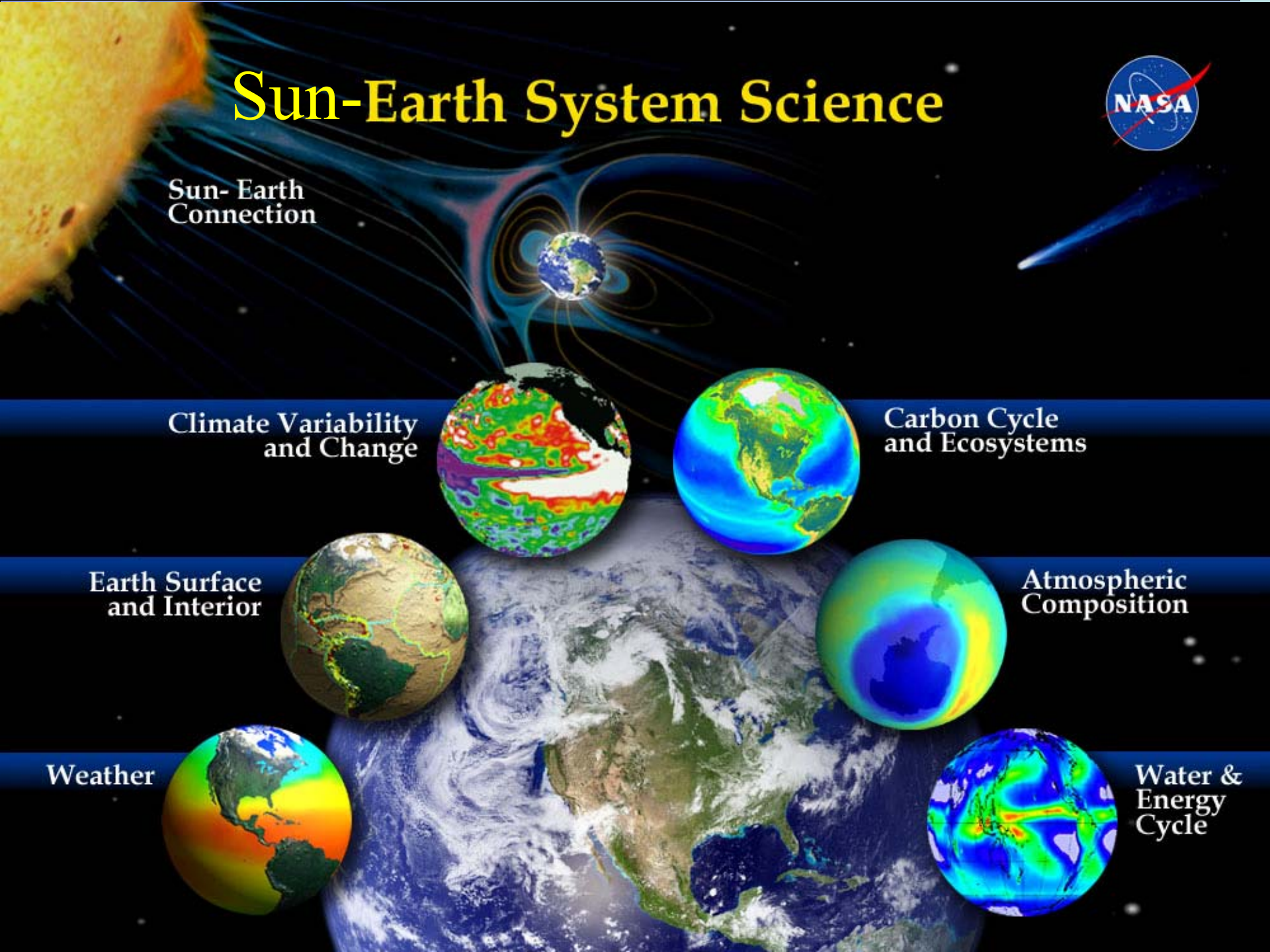
NASA Science Research & Systems benefiting Society

Ronald J. Birk
Applied Sciences Program
NASA Science Mission Directorate


Wind
Voyager 1 & 2
RHESSI
Geotail
Jason-1
Aqua
QuikSCAT
SOHO
TIMED
ERBS
TRACE
Cluster
ACE
ACRIMSAT
IMAGE
Landsat 7
NMP/EO-1
Ulysses
TOREX/Poseidon
Polar
TRMM
FAST
SAGE III/METEOR-3M
SORCE
UARS
GRACE
SeaWiFS
EP-TOMS
Terra
ICESat
Aura

Sun-Earth System Science



October 21-23, 2004

From Observations to Knowledge Products

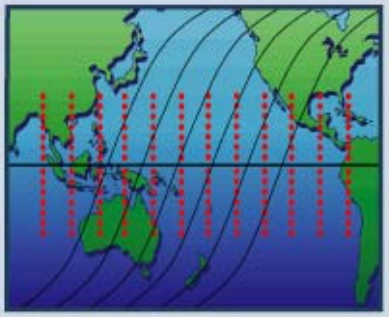
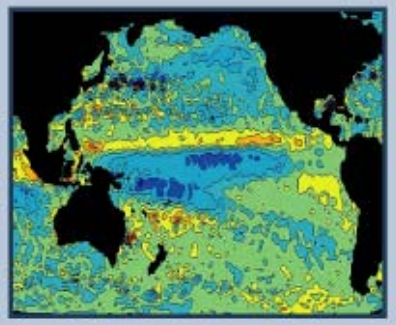
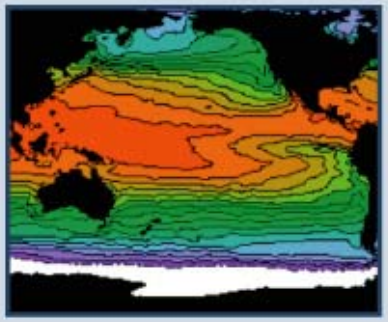
"from photons to electrons to neurons"

Downlink Speed

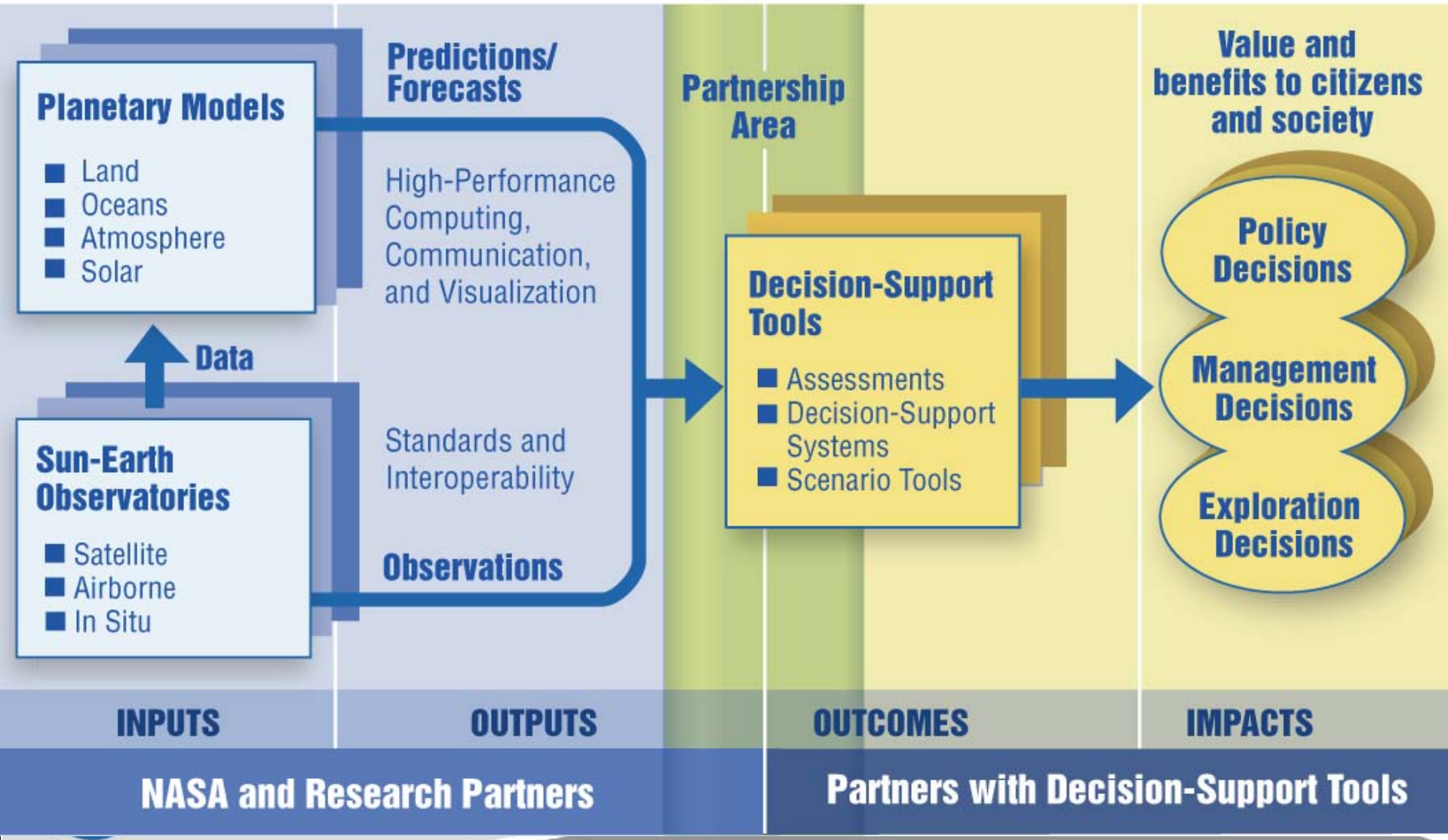
Petabytes 10^{15}	Terabytes 10^{12}	Gigabytes 10^{9}	Megabytes 10^{6}
Multi-platform, multiparameter, high spatial and temporal resolution, remote & in-situ sensing	Calibration, Transformation To Characterized Geo-physical Parameters	Interaction Between Modeling/Forecasting and Observation Systems	Interactive Dissemination and Predictions
Advanced Sensors	**Data Processing & Analysis**	**Information Synthesis**	**Access to Knowledge**






Integrating Knowledge, Capacity and Systems from NASA Research into Solutions



Applications of National Priority

Agricultural Efficiency

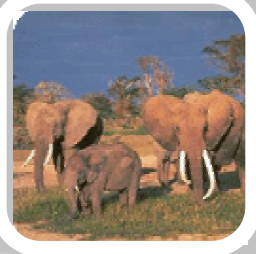
Air Quality

Aviation

Carbon Management

Coastal Management

Disaster Management



Ecological Forecasting

Energy Management

Homeland Security

Invasive Species

Public Health

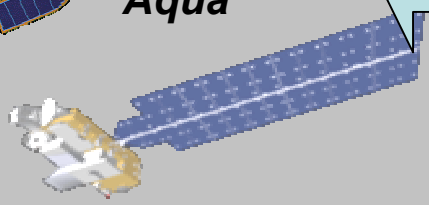
Water Management

National Application	Partner Organizations	Decision-Support Systems
Agricultural Efficiency	USDA,NOAA	CADRE—Crop Assessment Data Retrieval and Evaluation (USDA)
Air Quality	EPA,NOAA,USDA	CMAQ—Community Multiscale Air Quality Modeling System AIRNow AQI—Air Quality Index
Aviation	DOT/FAA,NOAA	NAS-AWRP—National Air Space-Aviation Weather Research Program
Carbon Management	USDA,DOE,NOAA	CQUEST—Support to the Energy Act of 1992,Section 1605b
Coastal Management	NOAA,EPA,NRL	HAB—Harmful Algal Bloom Bulletin/Mapping System CREWS—Coral Reef Early Warning System
Disaster Management	DHS/FEMA,NOAA,USGS,USFS	AWIPS—Advanced Weather Interactive Processing System HAZUS-MH—Hazards U.S.—Multi-Hazards
Ecological Forecasting	USAID,NOAA,NPS,CCAD,USGS	SERVIR—Regional Visualization and Monitoring System
Energy Management	DOE,UNEP,NOAA,NRC	RETScreen—Energy Diversification Research Laboratory (CEDRL) NEMS—National Energy Modeling System
Homeland Security	DHS,USGS,NOAA,NGA,DOD	IOF—Integrated Operations Facility IMAAC—Interagency Modeling and Atmospheric Assessment Center
Invasive Species	USGS,USDA,NOAA	ISFS—Invasive Species Forecasting System
Public Health	NIH,CDC,DOD,EPA	PSS—Plague Surveillance System EPHTN—Environmental Public Health Tracking Network MMS—Malaria Monitoring and Surveillance RSVP—Rapid Syndrome Validation Project
Water Management	EPA,USDA,USGS,BoR	RiverWARE—Bureau of Reclamation decision-support Tool AWARDS—Agricultural Water Resources and decision-support Tool BASINS—Better Assessment Science Integrating Point and Nonpoint Source

Air Quality

TOMS-EP

Aqua



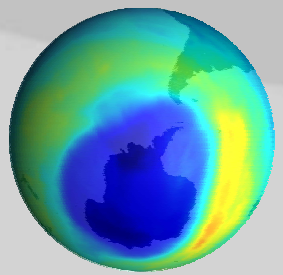
Tasking

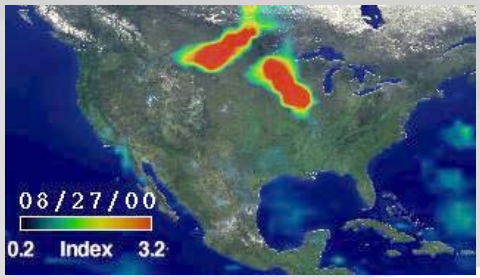
EDOS: Mission Control

Downlink

Societal Benefits

Exploitation



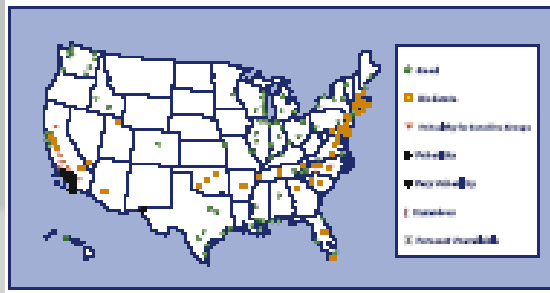


EOSDIS & DAACs

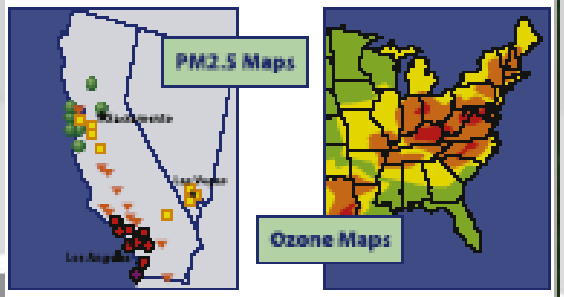
AIRNOW
www.epa.gov

The U.S. EPA has developed the AIRNow website to provide the public with easy access to national air quality information. This website offers daily Air Quality Index forecasts as well as real-time conditions for over 300 cities across the U.S.

Ozone and PM2.5 Forecasts

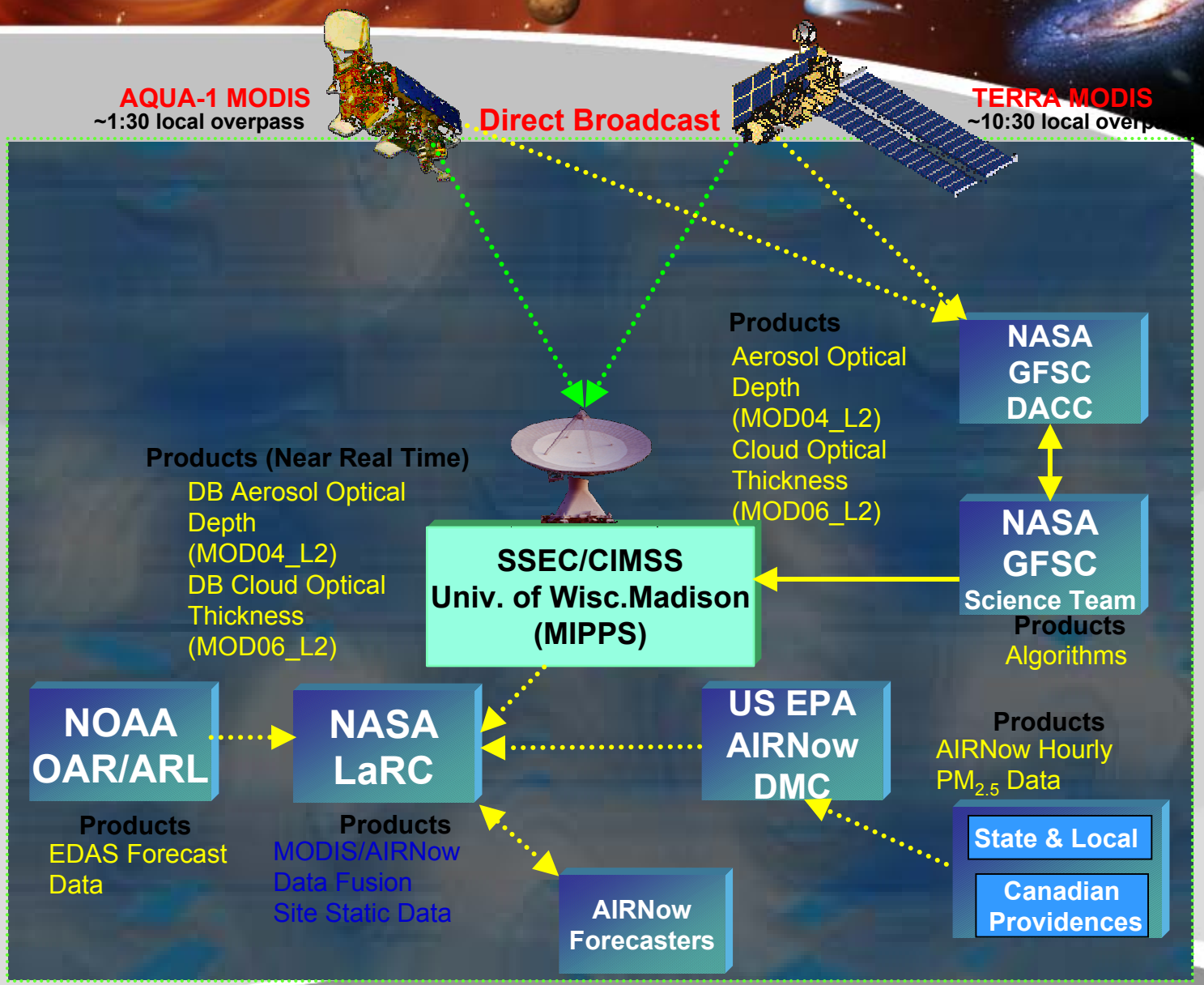


Current Air Quality Conditions



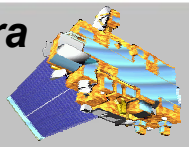
EPA AIRNow Use of MODIS Data

Terra & Aqua Satellite Direct Broadcast of MODIS instrument data via commercially available ground station

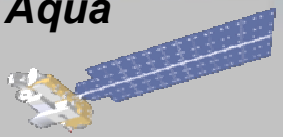


Applying Aerosol Optical Depth for AirNow and Air Quality Forecasting

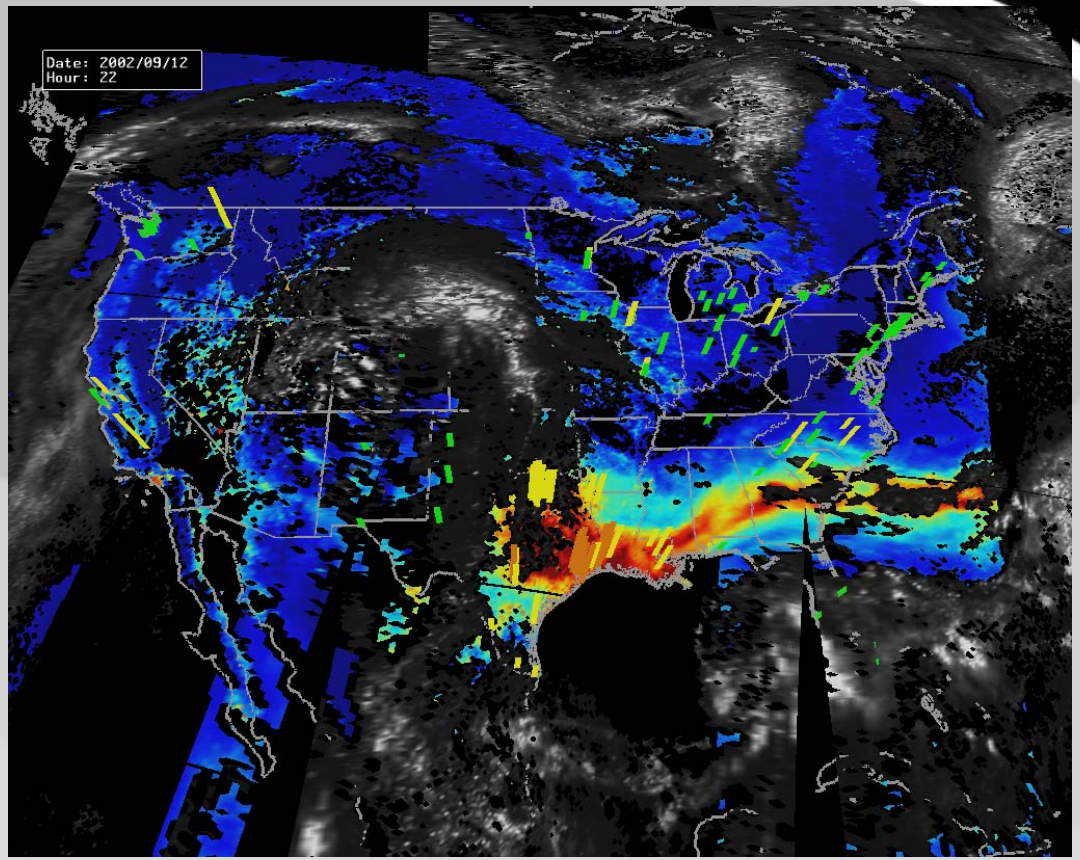
Terra



Aqua



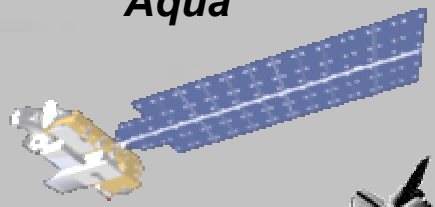
- MODIS Aerosol Optical Depth (AOD) supports EPA/NOAA air quality forecasting & EPA aerosol transport rule making
- Sept. 2003 - successful
- for NASA INTEX field campaign



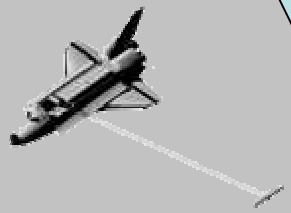
MODIS aerosol optical depth & EPA ground measurements of PM2.5.

Aviation

Aqua



SRTM

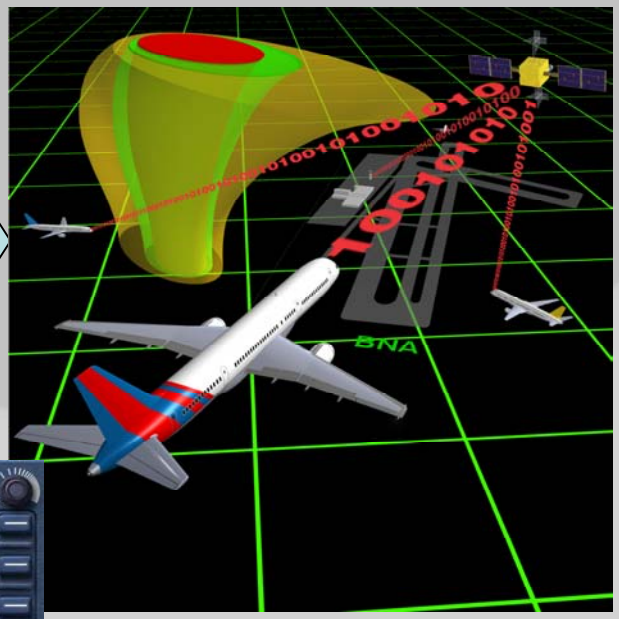


Tasking

EDOS: Mission Control

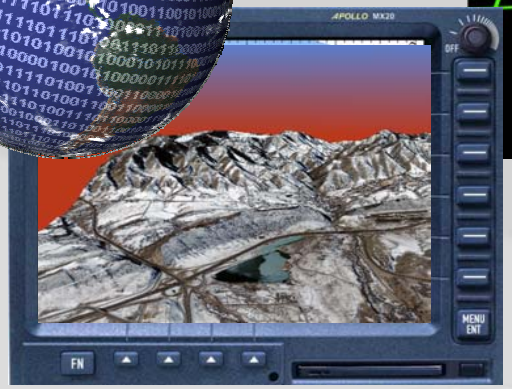
Downlink

Societal Benefits



Digital Airspace for National Airspace System

Exploitation



Synthetic Vision System display

EOSDIS & DAACs

Aviation

Integrated System Solution

EARTH SYSTEM MODELS

- **Weather:** *WRF, RUC*
- **Icing:** *FAA CIP, FAA FIP*
- **Convective Weather:** *CIMSS Convective Cloud Mask, FAA NCWF & OCWF*
- **Ceiling/ Visibility:** *FAA NCVP*
- **Turbulence:** *FAA GTG, ITFA*

**Supported Non-NASA Model*

Data

EARTH OBSERVATORIES

GOES, METEOSAT, GMS, TOMS, TRMM,QuikScat (SeaWinds), Terra, Aqua (MODIS, AIRS)
GIFTS Imager and Sounder
NPP, NPOESS, etc
•CrIS, IASI, NOAA-series

Airborne/Field Ex. -- PIREPS, TAMDAR THORPEX, AIRS, IHOP, CRYSTAL

IPO -- NAST, CPL, MAS, Wind Lidars

DOD Assets – GPS, DMSP, IAEAsats

**Future Mission*

Predictions

- Convective Weather
- Turbulence
- Icing
- Ceiling and Visibility
- Volcanic Transport
- Oceanic Winds
- Winter Storms
- Tropical Cyclones

Observations

- Atmospheric Temperature
- Atmospheric Water Vapor
- Atmospheric Winds
- Storm Cell Properties
- Volcanic Gas & Ash
- Cloud Properties
- Global Precipitation

DECISION SUPPORT TOOLS

- **NAS-AWRP** (National Airspace System- Aviation Weather Research Program)
- **Key weather observations**
- **Nowcasting Products**
- **24 Hour precise continuous atmosphere**
- **Weather warnings and predictions**
- **Accurate and easily accessible weather forecasts**
- **Increase in understanding of atmospheric conditions**
- **Real time interest fields**
- **Comprehensive image library**

Management Decisions

- **Routing of Flights**
- **Turbulence/convective weather avoidance**
- **Fuel/Landing loads**

VALUE & BENEFITS

- **Improved Safety**
- **Improved Airline Efficiency**
- **Earlier warnings of hazardous weather**
- **Reduction in the cost of flying**

Aviation

Earth Science research results improve wx products for the NAS

State 2-**WX Visualization Systems**: Fully integrated **SVS, WARP & ITWS** in-cockpit graphical WX displays featuring real-time weather information with global coverage

State 2- **WX Sensors/Data Sources: AIRS, CrIS &** hyperspectral data fully integrated into **NEXRAD & TDWR** systems; prepared for seamless integration of **ABS** (GOES-R)

Socioeconomic Impact

Partners:

EOS, NPP, NPOESS & GOES-R

NAS-wide Data Link WX Products provide severe weather location and movement data to controllers and aircrews to promote common situational awareness

Hyperspectral data & Weather Prediction Modeling

Geostationary satellite technology improvements will vastly improve remote measurement of altitude-resolved vector winds and temperatures, allowing for efficient flight planning, operations and traffic management.

Aqua and NPP fly the AIRS and CrIS sensors (Atmospheric Infrared Sounder and Crosstrack Infrared Sounder)

High spectral (vertical), horizontal and temporal resolution satellite measurements will render precise numerical weather forecasts and extremely high-resolution wind fields based on the tracking of atmospheric water vapor

NAST (I) Atmospheric Sounder Testbed Infrared (Proteus) Experiments

Airborne validation of NPOESS instruments provides DSS product development teams with experience at integrating hyperspectral data and information in preparation for subsequent hyperspectral missions

Advanced Satellite Applications Products (ASAP) Program

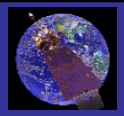
Integration of existing GOES imagery and sounding data into AWRP products improve CIP/FIP, Terminal Convective WX product and Integrated Turbulence Forecast

State 1-**WX Visualization Systems**: Discrete, Stand-alone weather products, with little satellite sounding data or imagery

State 1-**WX Sensors/Data Sources:** Ground Doppler Radar, 2x daily balloon readings yield 6 to 12-hour forecasts; poor oceanic coverage

Current trajectory:

Steady improvement in fielding and integration of hyperspectral LEO and GEO satellite data into NWS aviation weather products and AWRP visualization systems, resulting in fully integrated, real-time global aviation WX coverage


GOES-L,-M

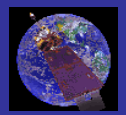

Aqua


Proteus


NPP/VIIRS


HYDROS


*NPOESS


GOES-R

*Pre-formulation

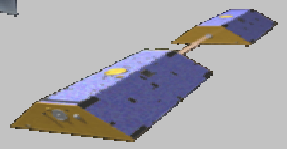
2003 2005 2007 2009 2011 2012

Enhanced Aviation Weather DSS and synthetic vision systems that reduce the aviation fatal accident rate by a factor of 10 by 2022

Disaster Management

QuikScat

GRACE



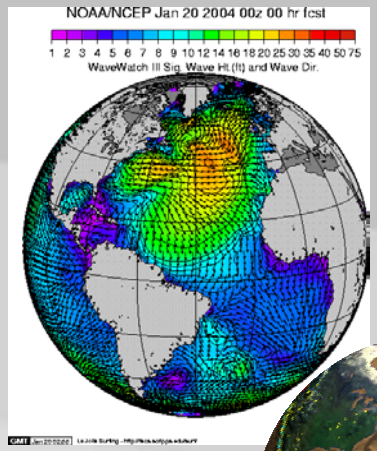
Tasking

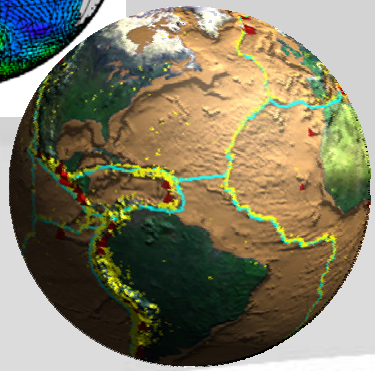
EDOS: Mission Control

Downlink

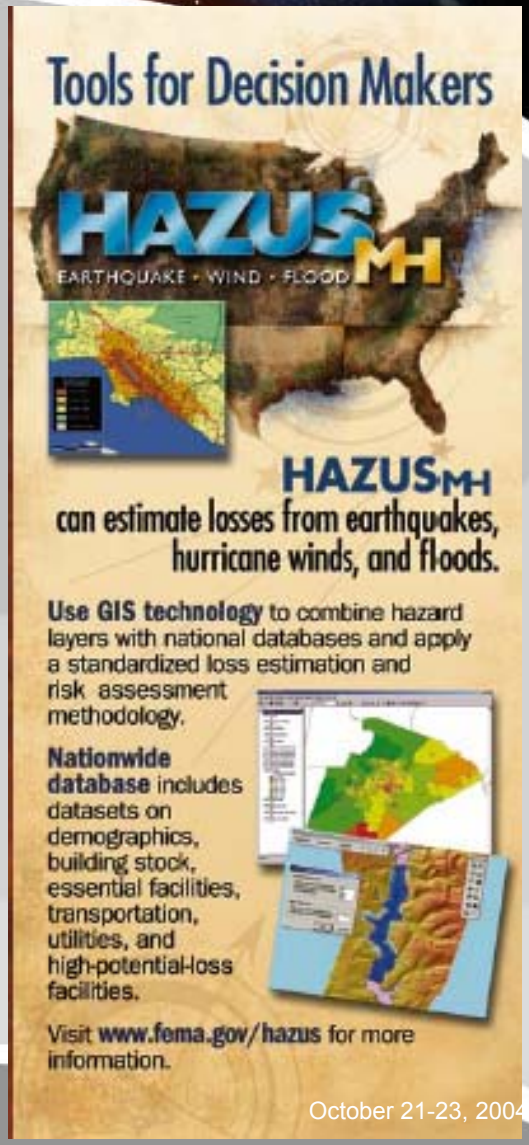
EOSDIS & DAACs

Exploitation



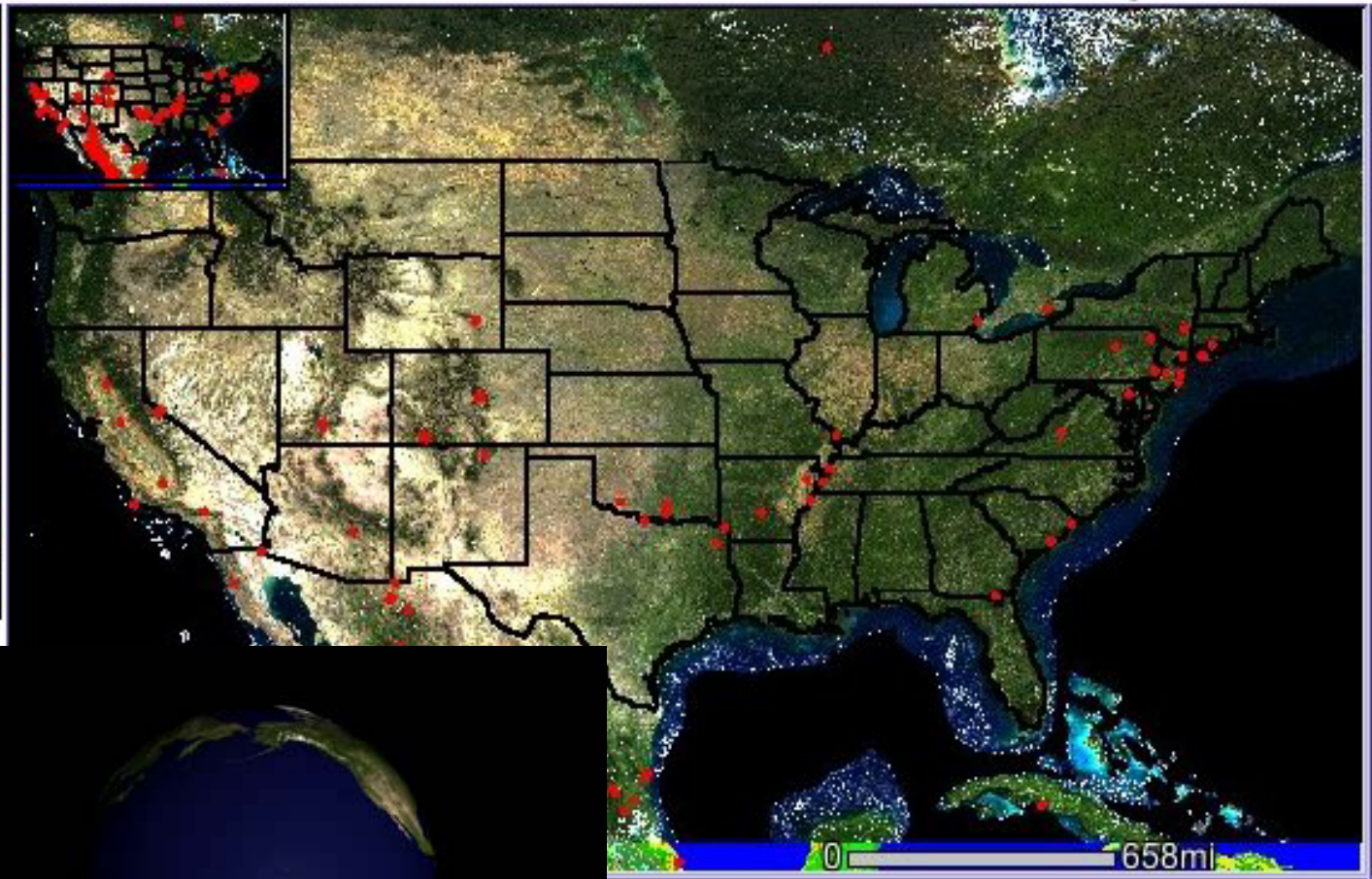


Societal Benefits



MODIS Rapid Response Project

Continental US Web Fire Maps



Layers

Visible Active

- MODIS Active Fire Detections
- Continental US
- MODIS Surface Reflectance 500M
- AVHRR Land Cover (GLCF)

Refresh Map

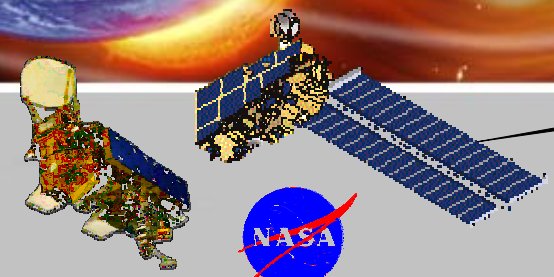
Date Query

Enter the dates in YYYY-MM-DD format.

Start Date 2002-06-17

End Date 2002-06-19

USFS use of MODIS for Fire Management

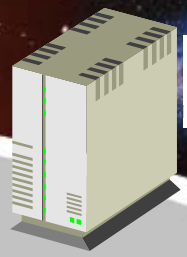


Aqua & Terra

Direct Broadcast
Receiving Station

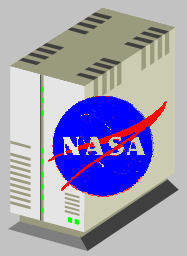
L1B Data

October 2001



USDA Forest Service
Remote Sensing
Application Center

Backup Feed
L1B Data



Rapid Response System
NASA/GSFC

Active Fire
Locations

Cumulative Fire Maps
http://www.nifc.gov.firemaps.html

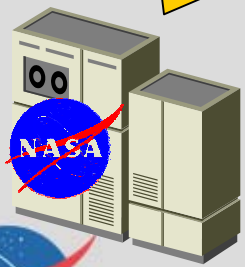
Burn Severity Maps
Handcrafted Imagery

EDOS

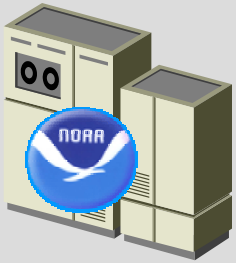
MODIS
L0 Data

Active Fire Locations
Selected Imagery

University of Maryland
Geography Dept



GES DAAC
NASA/GSFC

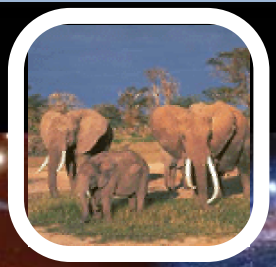


NOAA

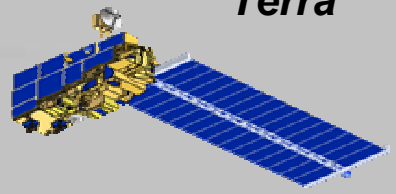
Active Fire and
Corrected Reflectance
http://rapidfire.sci.gsfc.nasa.gov

Web Fire Maps
http://rapidresponse.umd.edu

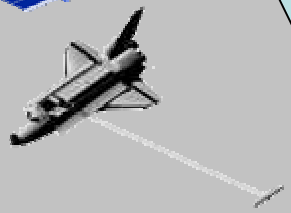
Ecological Forecasting



Terra



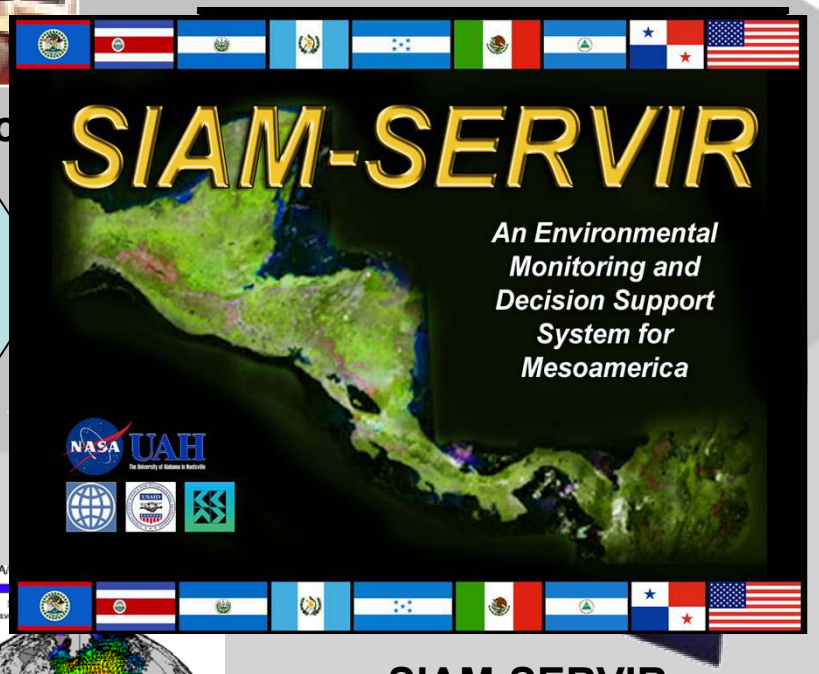
SRTM



Tasking

EDOS: Mission Co

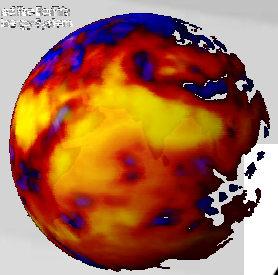
Societal Benefits

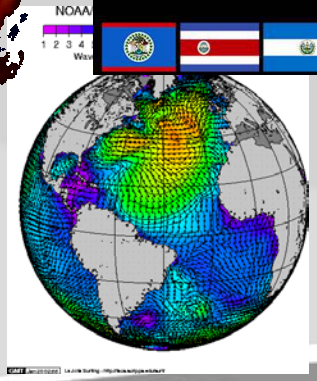


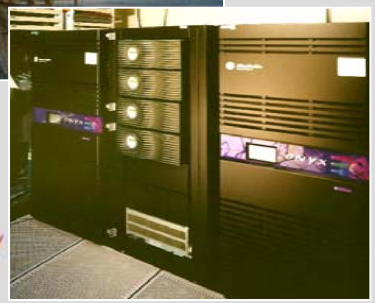
SIAM-SERVIR
Center in Panama City

Downlink

Exploitation

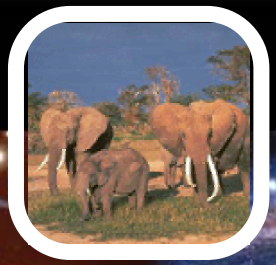






EOSDIS & DAACs

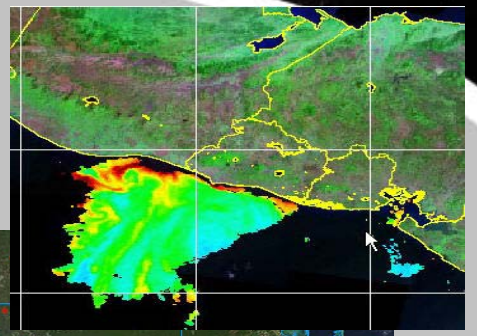
SIAM-SERVIR

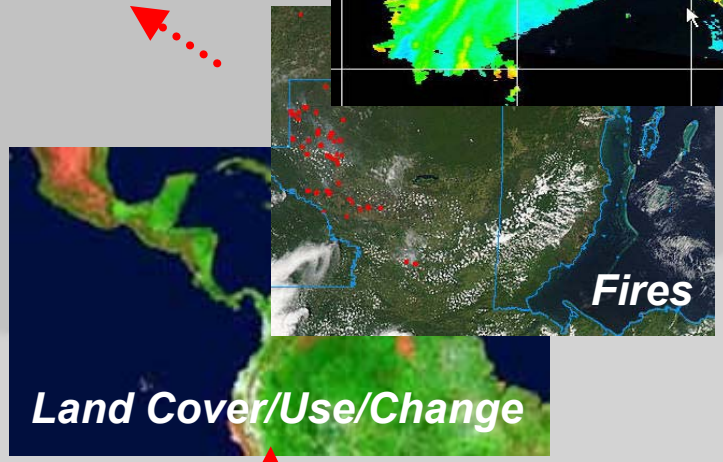


Electronic Transfer

Central American Commission for Environment and Development

- Emergency Responders
- Environmental Managers
- Political Leaders
- Researchers, Educators





SERVIR Node @ NSSTC

(NASA/MSFC and U. Alabama in Huntsville)

Product Generation System

Web Server
servir.nsstc.nasa.gov

Visualization System

- Distribute Products
- Archive Products

Source Data Archive

Product Archive

Rapid Response
e-access

SERVIR Node in Panama

University of Arkansas
(World Bank Funding)

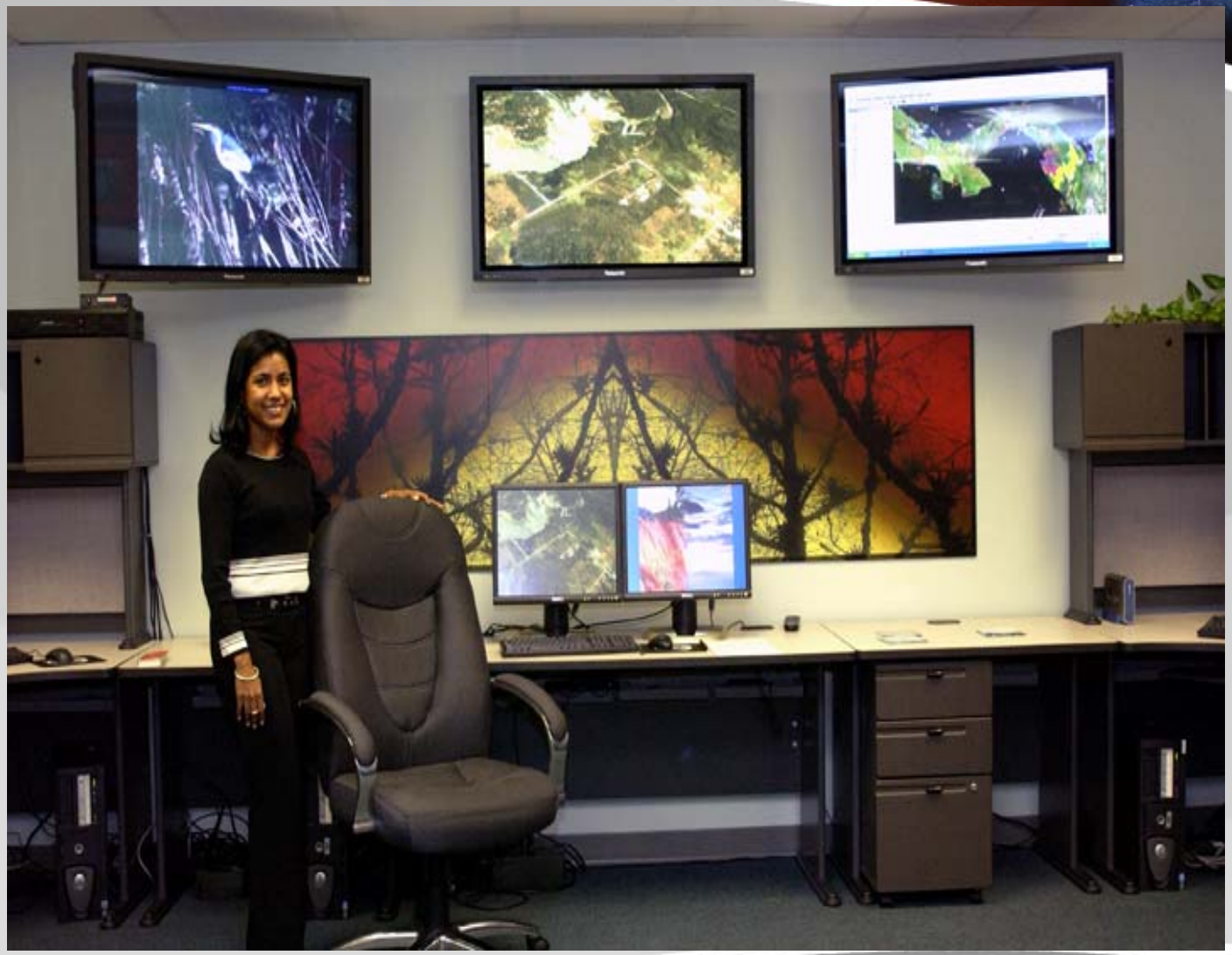
- Geographic Info Systems
- Decision Support Systems
- Environmental Data from Central American countries

Data & Algorithms

Goals

- Rapid Response
- Corridor Preservation
- Species Preservation
- Sustained Development
- Better Living Conditions
- Policy Changes

SERVIR Test Bed Node @ NASA/MSFC in 2004



SERVIR Lab in Panama in the City of Knowledge

Homeland Security

Aura

QuikScat

Tasking

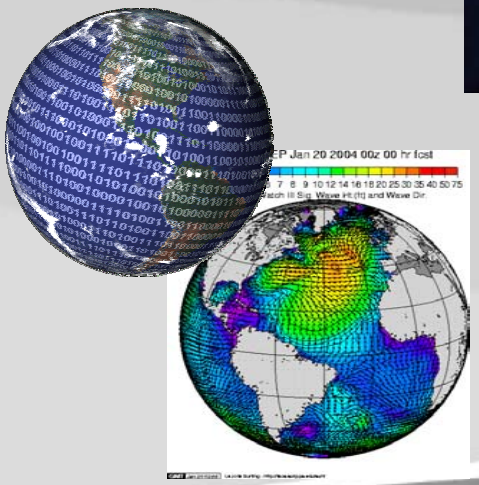
EDOS: Mission Control

Downlink

Societal Benefits

Interagency Modeling Atmosphere Assessment Center (IMAAC)

Exploitation



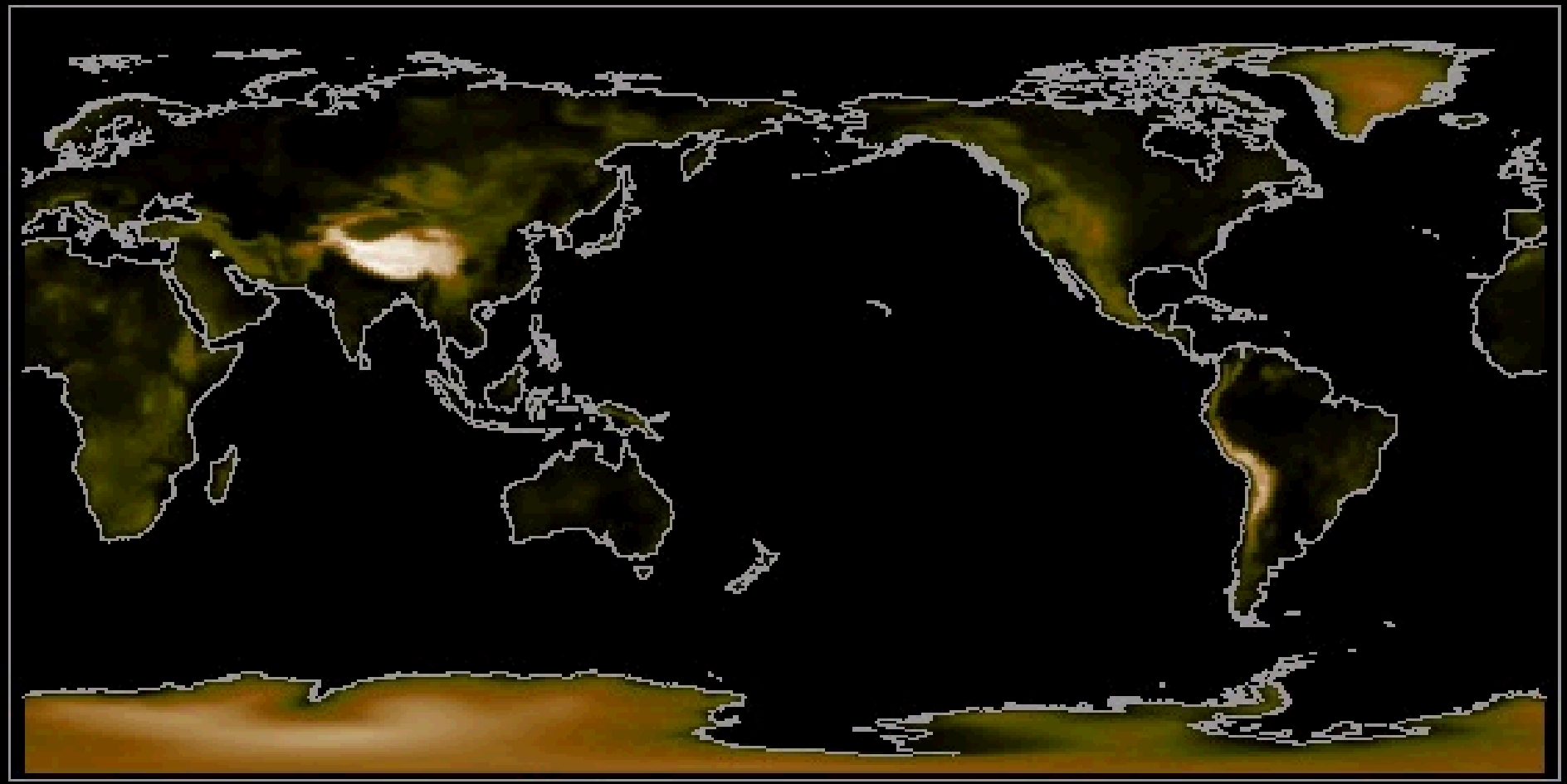
EOSDIS & DAACs

Homeland Security

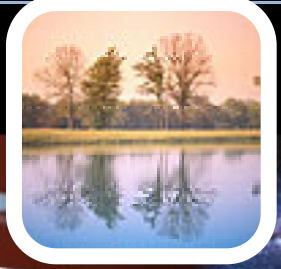
Plume Dispersion

Plume Dispersion Modeling with the NASA fvGCM

2002 Sep 21 01Z



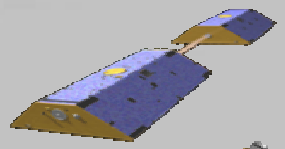
Water Management



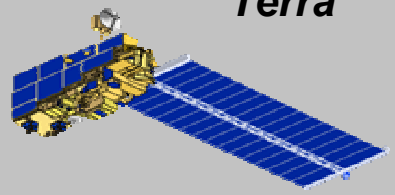
Bureau of Reclamation
Managing Water In The American

USGS
science for a changing world

GRACE



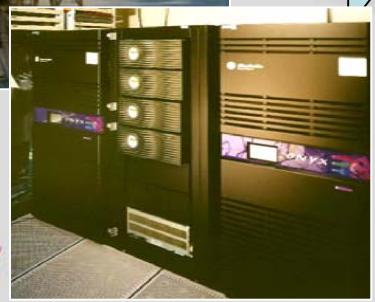
Terra



Tasking

EDOS: Mission Control

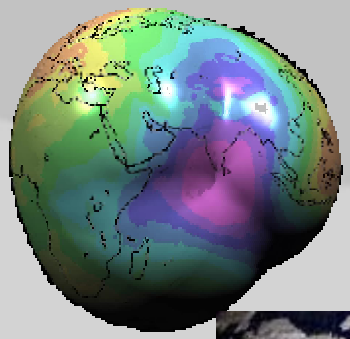
Processing

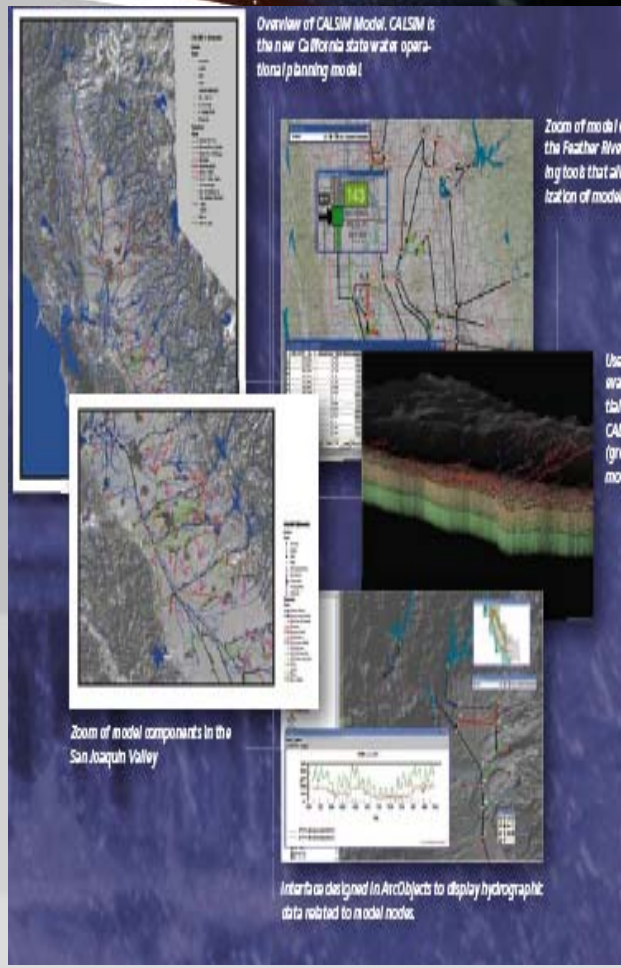


EOSDIS & DAACs

oloitation

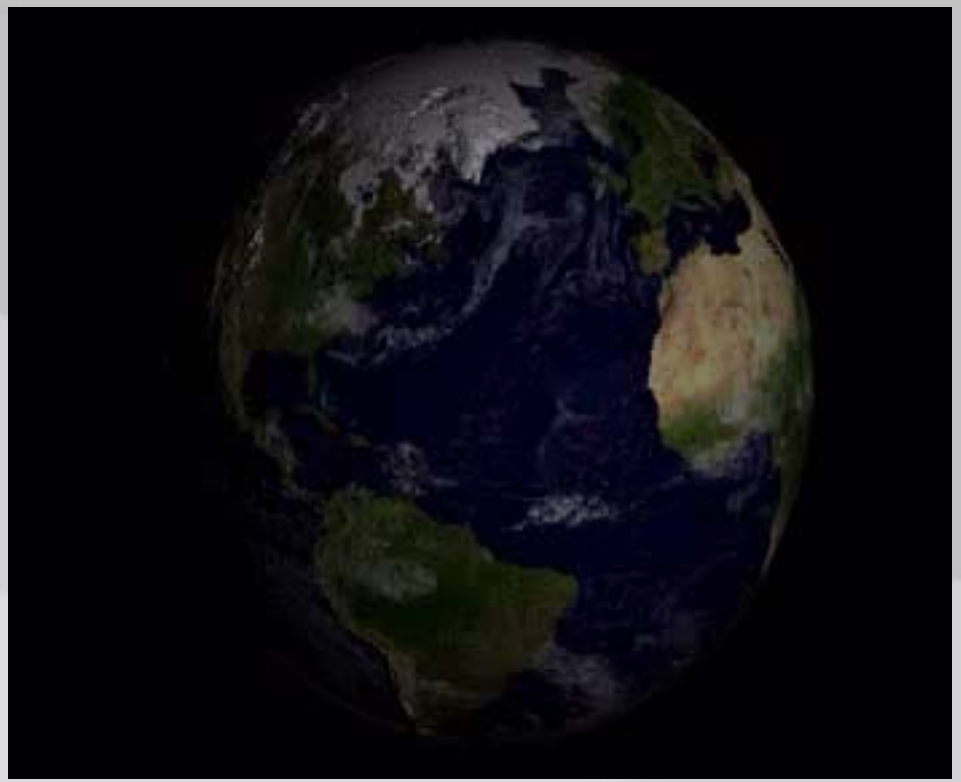
Societal Benefits



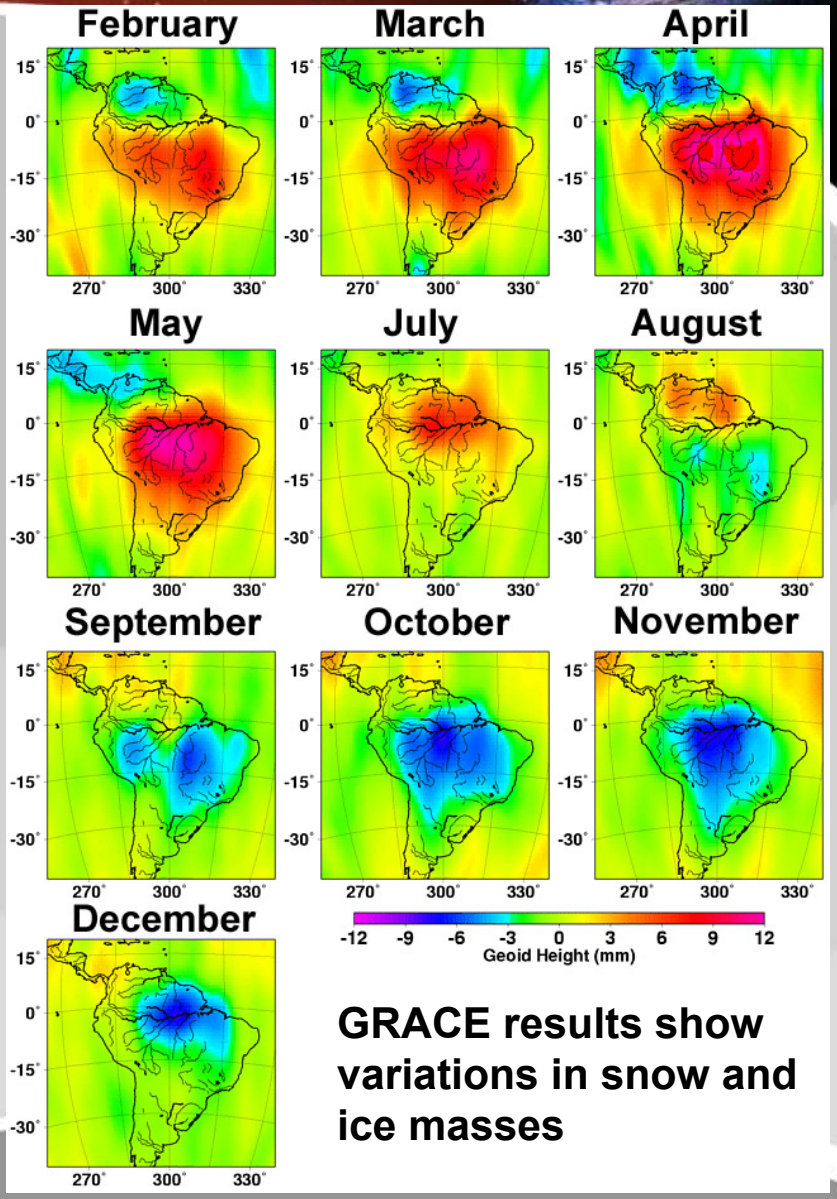


Riverware & AWARDS

Evaluating the use of Water Cycle Research Results

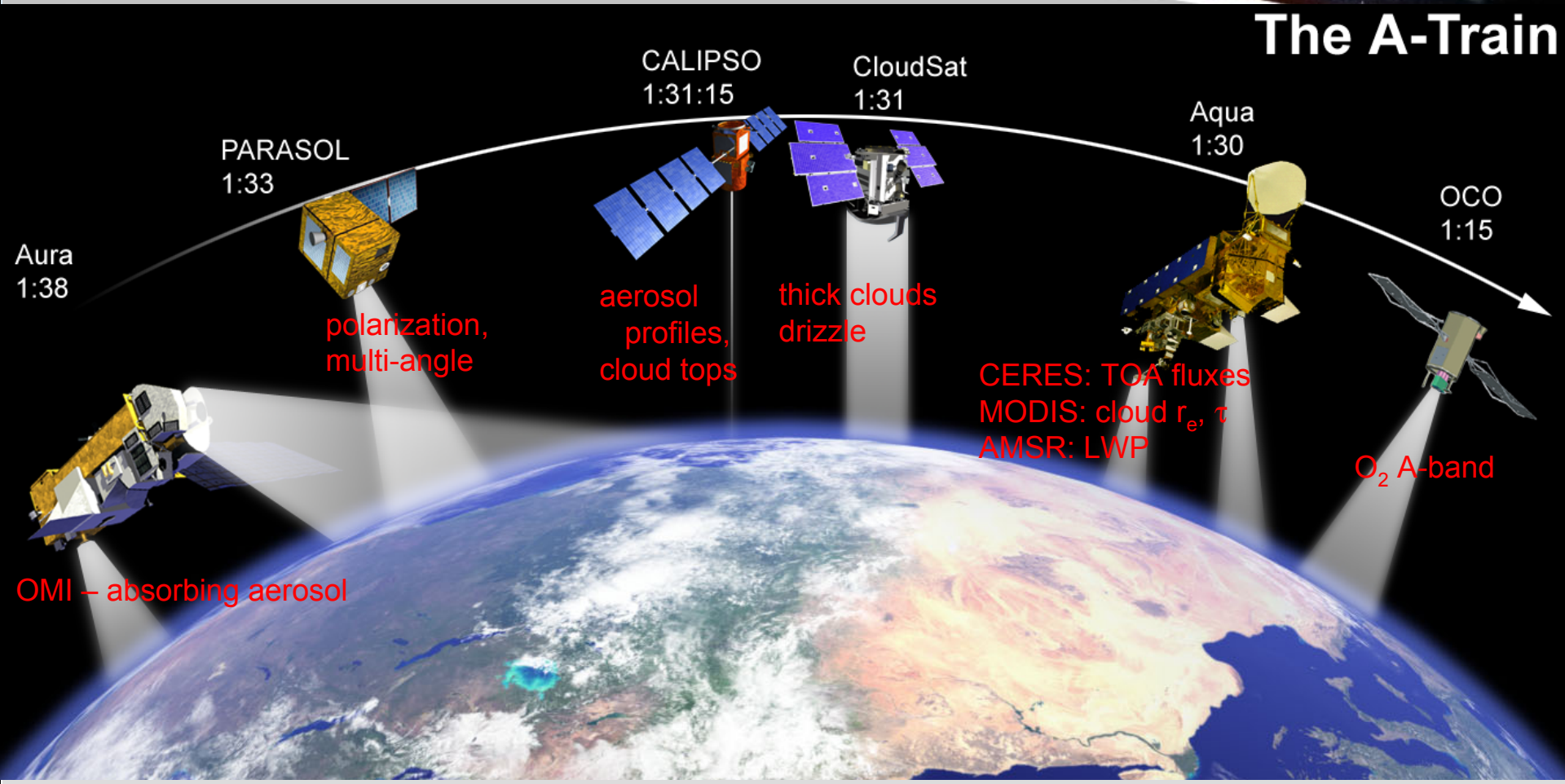


Variation in global snow cover for the period from 2001- 2002 derived from NASA observations

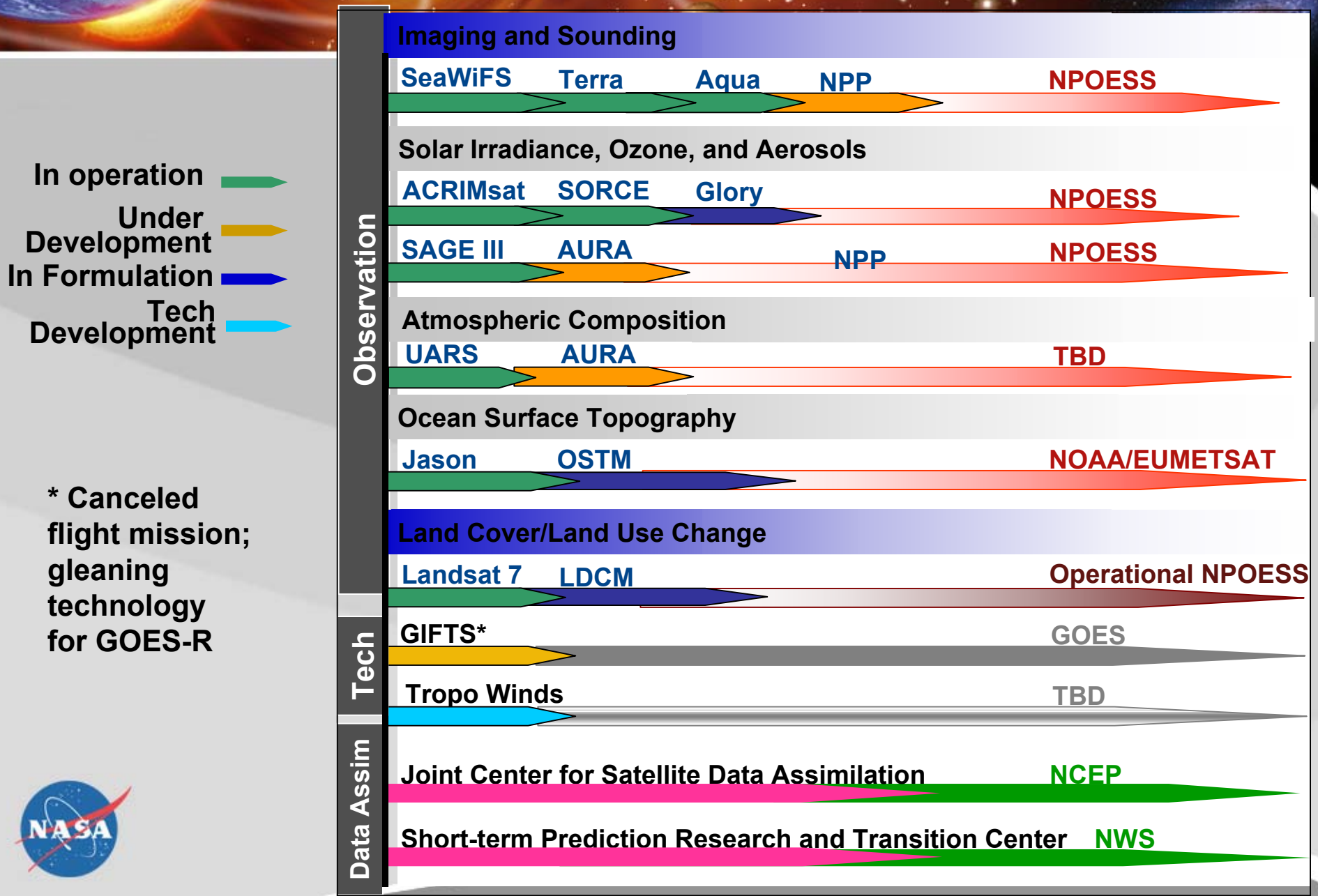


GRACE results show variations in snow and ice masses

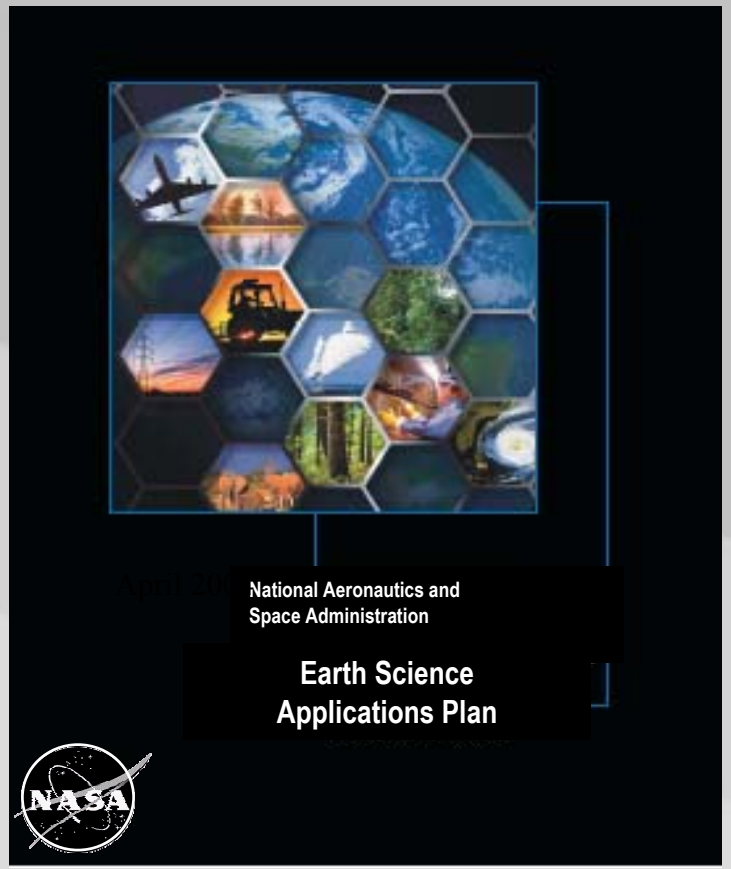
Earth Observation System A-Train: Aerosol/Clouds/Radiation

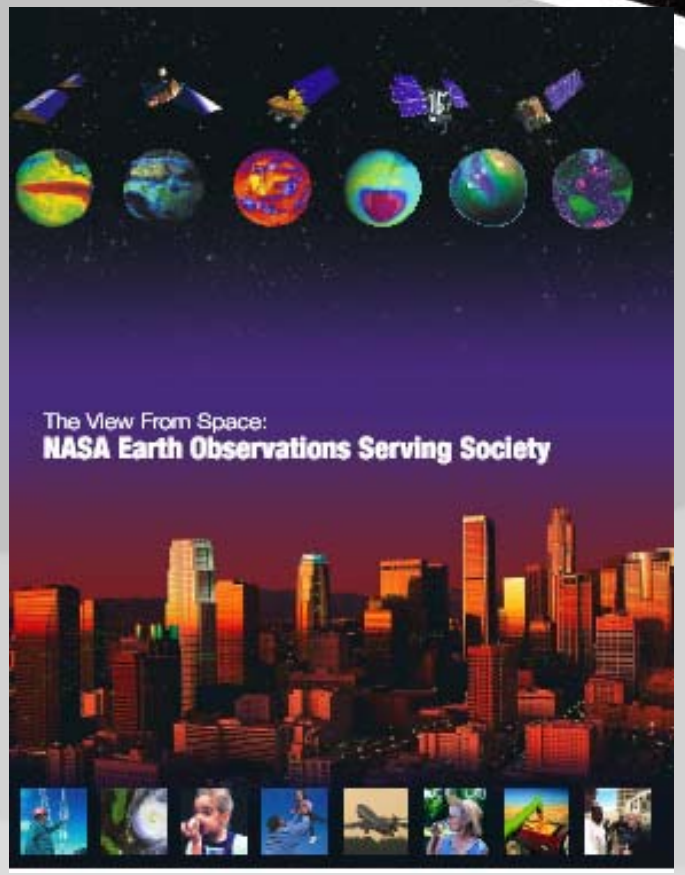


Transition of Research Results to Operations



Accessible Information





http://science.hq.nasa.gov/earth-sun/applications

NASA

Solicitation: Decision Support through Earth Science Results

General Information

Document Type: Pre-solicitation Notice Solicitation Number:NN-H-04-Z-YO-010-C
Posted Date: Sep 03, 2004 Response Date:Jan 21

Description

The National Aeronautics and Space Administration (NASA) is announcing opportunities to participate in the Applied Sciences Program of the Science Mission Directorate. The Program requests innovative solutions to evaluate, verify and validate, and benchmark solutions that **integrate NASA Earth and Space science results into decision-support tools of partnering organizations**.

Proposals are invited in two main areas:

1) Integrated Systems Solutions to integrate NASA Earth and Space science results into applications of national priority, demonstrate prototypes, and benchmark performance, and
2) Solutions Networks to improve the collective ability of Earth science organizations to interact and harness the results of NASA Earth and Space science research.

Participation in the CAN is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA research centers, and other government agencies and laboratories.

The Advance of

Science at NASA

WE WILL BE...

WE ARE...

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